Australian Government

Australian Transport Safety Bureau

Loss of control involving a Cirrus SR22, N802DK

near Katoomba, New South Wales, 10 May 2014

ATSB Transport Safety Report

Aviation Occurrence Investigation

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Addendum

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Loss of control involving a Cirrus SR22, N802DK

What happened

Damage to N802DK

Source: NSW Police Force

On 10 May 2014, an accredited Cirrus salesman planned to conduct a sales demonstration flight of a Cirrus SR22 aircraft, registered N802DK, in the local training area, from Bankstown Airport, New South Wales.

The aim of this flight was for the prospective purchaser, who was the holder of a private pilot licence, to experience the aircraft handling and systems. As the salesman was a flight instructor, he was the pilot in command (PIC) for the flight and was seated in the front right seat. The potential buyer of the aircraft was a passenger on the flight and was seated in the front left seat. There was also a passenger in the rear seat. The passenger in the front seat had previously had one flight in the aircraft (also as a passenger) and had subsequently expressed some concerns about the stall and spin characteristics of the aircraft.

As part of the normal start up procedures, the PIC removed the safety pin from the Cirrus Airframe Parachute System (CAPS) handle prior to placing the ignition key in the ignition switch. At about 1330 Eastern Standard Time (EST), the PIC reported that he taxied the aircraft to the run-up bay and performed the engine run-ups, and explained and checked each item on the electronic checklist; however the passenger in the front seat reported that he did not observe these checklists being actioned. The passenger in the front seat conducted the take-off, and established the aircraft in a climb heading to the training area in a north-westerly direction. The PIC talked about the aircraft systems, controls and instrumentation, and the Electronic Stability and Protection system.

Due to smoke from back-burning fires in the training area, the PIC elected to track towards Katoomba at about 6,000 ft above mean sea level (AMSL) to conduct a series of manoeuvres to demonstrate the electronic stability of the aircraft. The passenger in the front seat conducted a 30° angle of bank turn. The instructor then described that when 45° angle of bank was exceeded, the electronic stability system increased the pressure against the control stick to return the aircraft to 30° of bank; however that could be overridden by the pilot applying greater force. The PIC then suggested the passenger in the front seat perform a 60° turn to the left.

The passenger in the front seat asked the PIC whether he should increase the power setting prior to commencing the steep turn, however was advised that it was not necessary and the power remained at about 24 inches Hg manifold pressure. He reported that significant back pressure on the control stick was required and he was unable to maintain altitude throughout the steep turn with that power setting.

The PIC then stated that they would demonstrate a stall[1] with the wings level. The passenger in the front seat reduced the power to idle, held the nose of the aircraft up to allow the airspeed to reduce, and the stall warning message appeared on the primary flight display. The PIC directed him to hold that attitude until the stall buffet was felt and then the nose of the aircraft dropped and the passenger in the front seat recovered the aircraft from the stall.

The PIC then took control of the aircraft and stated ‘watch this’. He selected 50% flap, rolled the aircraft into a left turn at about 25° angle of bank, reduced the power to idle, and raised the nose

[1] Aerodynamic ‘stall’ is the term used when a wing is no longer producing enough lift to support an aircraft's weight.

of the aircraft. The passenger in the front seat queried the use of flap and the PIC confirmed it was intended. As the aircraft approached the stall, the PIC pointed to the vertical speed indicator. As he did this, the right wing dropped rapidly and the aircraft entered a spin to the right. The PIC reported that at this time he performed his normal recovery procedure from this manoeuvre: maintained a neutral aileron control position, applied forward pressure on the control stick to pitch the aircraft nose down, rudders neutral and applied power. He reported that he moved the throttle lever forwards to increase power however there was a distinct hesitation in the engine response.

The passenger in the front seat reported that on about the third rotation of the spin, the PIC said 'I'm sorry', and he realised that the PIC had lost control of the aircraft. The passenger in the front seat reported that he applied full left rudder in an attempt to counter the rotation.

As the rate of rotation to the right slowed, the passenger in the front seat felt the PIC apply right rudder, and the aircraft again accelerated rotating to the right. When about 2,000 ft above ground level, the PIC was unsure whether he then had enough height remaining to recover control of the aircraft, and elected to deploy the parachute. He reported that at this stage, he said 'I'm sorry'. The rocket fired and a loud bang was heard. The aircraft initially pitched up slightly and then as the parachute deployed, the aircraft pitched down rapidly into a nose-low attitude. The PIC closed the throttle, selected the fuel mixture to idle cut-off and activated the emergency beacon. He reported that he also selected the fuel to 'OFF'. About 6 seconds after the rocket fired, the right snub line of the parachute released, followed by the left snub line, which then established the aircraft in a wings level attitude.

The aircraft was overhead high voltage powerlines and the passenger in the front seat asked the PIC whether there was any way to manoeuvre the aircraft to avoid them and was advised that there was not. The aircraft narrowly avoided the powerlines, collided with branches of a tree, and came to rest on a fence in the garden of a residential dwelling (Figure 1). The passenger in the front seat reported that he observed that the ignition and master switches and fuel selector were still 'ON' and selected them to 'OFF'. He reported that he had to shake the PIC as he appeared dazed, and told the PIC and the passenger to hurry up and open the door and exit the aircraft. The PIC reported that after exiting the aircraft he confirmed that no injuries had been sustained and spoke to National Search and Rescue personnel to confirm that the emergency beacon had been activated.

Figure 1: Accident site of Cirris SR22, N802DK

Source: NSW Police Force

Pilot comments

Passenger (front left seat)

The passenger in the front left seat reported that they were not given any safety briefing prior to the flight and there was no formal handing over/taking over procedure being followed during the flight. He had not been shown how to operate the CAPS and during the spin was uncertain as to how and whether to pull the handle. After the deployment of the CAPS, he was unsure as to the correct position to be seated in for landing, but recalled that the seats were designed to collapse to absorb shock so he opted to remain sitting upright with his feet firmly on the floor. When over the powerlines, he was unsure whether they could restart the engine to manoeuvre away from them.

Pilot in command (PIC) (front right seat)

The PIC provided the following comments:

- He was probably overconfident as he had done the demonstration 30-50 times in the previous 6 months.
- There was no specified routine and series of manoeuvres for a demonstration flight, unlike the specific syllabus for the accredited Cirrus ‘transition’ training flights.
- A formal handing over/taking over protocol was used during the flight.
- He thought that as the aircraft entered the spin, the passenger in the left seat had made an uncommanded rudder input.
- He normally demonstrates the manoeuvres in the training area and by tracking over the escarpment, he lost about 2,000 ft of safety height.
- He had performed the same manoeuvre earlier that day, without the subsequent loss of control.

Passenger (rear seat)

The passenger in the rear seat provided the following comments:

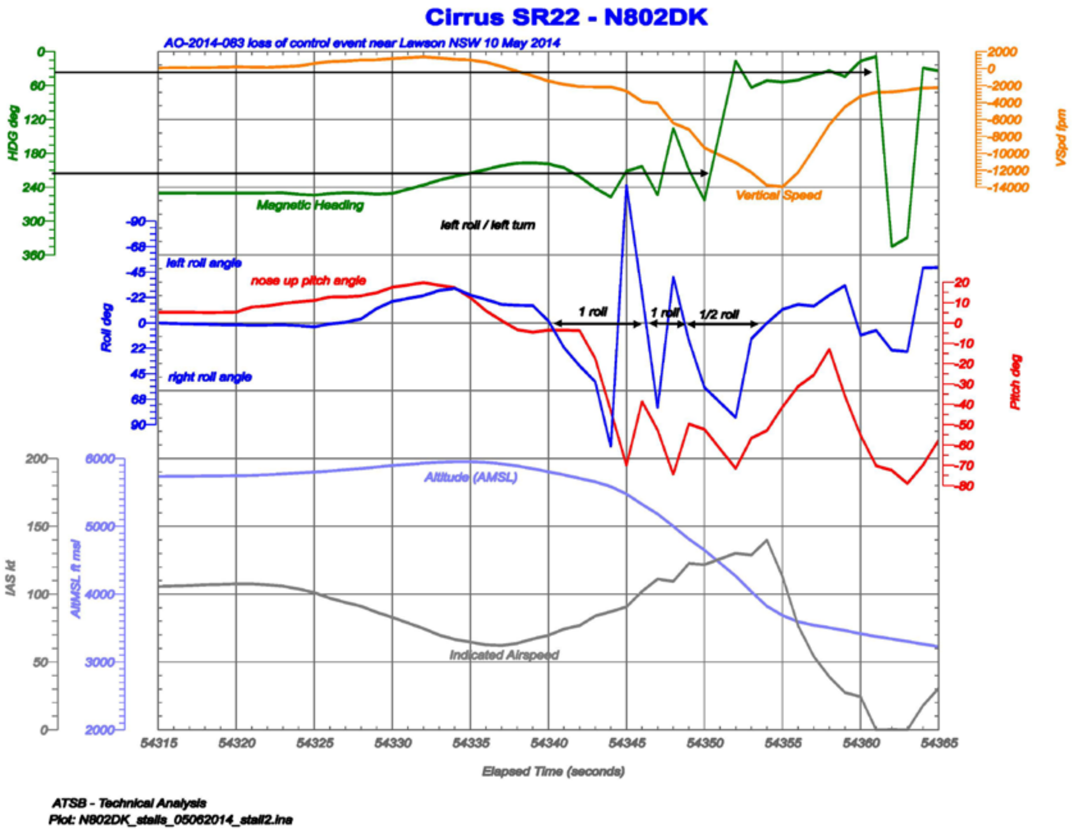
- The general tenor of the flight was very informal.
- There was no full safety brief including regarding exits, no handing over/taking over protocol, and no discussion regarding the use of the parachute.
- There was a lot of discussion during the flight regarding the stall and spin characteristics of the cuffed wing, with the PIC advising that the combination of the cuffed wing and electronic protections prevented the aircraft from stalling.
- There was a lack of communication about the stall demonstration; they were over rough terrain with insufficient height, and a passenger in the back seat.
- The only approved spin recovery in the aircraft was to deploy the CAPS.

Flight data

The aircraft flight data was provided to the ATSB and is shown in the following diagrams. The control input parameters were not recorded in the aircraft’s data.

At the commencement of the manoeuvre, when at about 5,800 ft AMSL, the aircraft nose pitched up to about 20°, and simultaneously entered a left turn with about 25° angle of bank (roll) (Figure 2). The maximum roll value in the turn was about 30° with a corresponding pitch angle of about 17°. The indicated airspeed reduced to about 62 kt. The right wing then dropped rapidly and the aircraft rolled to the right, the nose pitched down to about 70° and the aircraft commenced a nose low spin to the right. The first complete roll to the right took about 6 seconds and the second roll had a noticeably higher roll rate and took about 2.5 seconds. The roll rate then reduced, with the next 180° of roll taking about 5 seconds. The CAPS was deployed and the parachute inflated when the aircraft was about 1,000 ft above ground level. The aircraft continued to roll when the parachute inflated, and the aircraft nose pitched down about 80°. The maximum vertical speed reached about 14,000 feet per minute prior to the CAPS deployment.

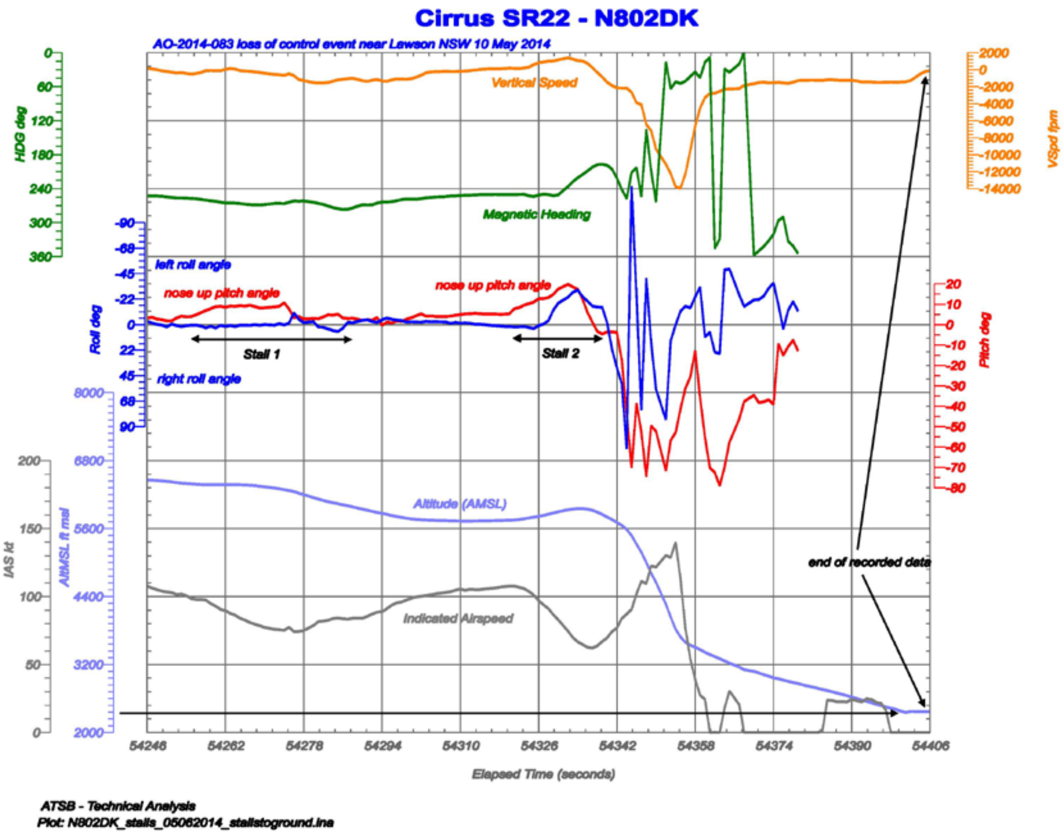
Figure 2: Roll and pitch data



Source: ATSB

Figure 3 shows the flight data from the commencement of the first stall until the aircraft collided with the ground. The nose up pitch angle in the first stall reached a maximum of about 9°, and in the second stall about 20° was reached. The first stall developed over a period of about 25 seconds before recovery and the second was about 16 seconds prior to the aircraft nose dropping below the horizon. In the first stall, the airspeed reduced from 100 kt to 75 kt in about 25 seconds, and in the second stall the airspeed reduced from about 100 kt to 62 kt in about 12 seconds.

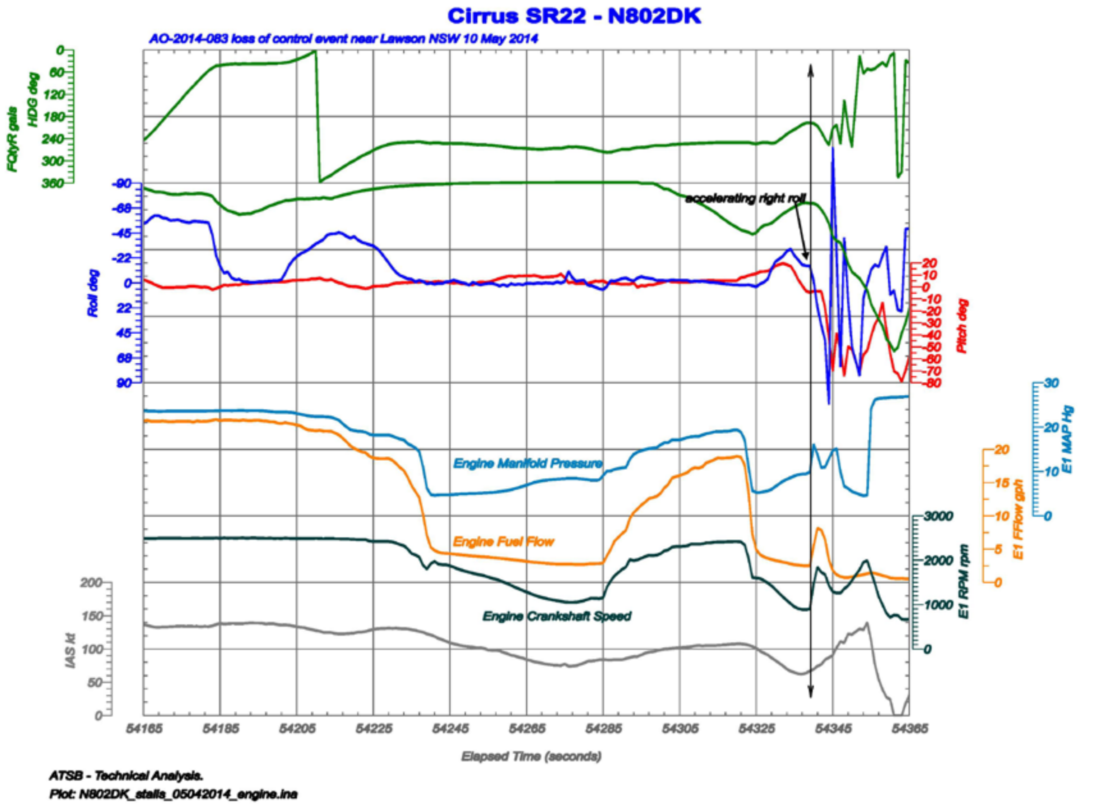
Figure 3: Flight data from N802DK



Source: ATSB

Figure 4 depicts the engine parameters during the steep turn, the wings-level stall and the subsequent stall, spin and CAPS deployment. The manifold pressure, fuel flow and crankshaft speed (rpm) were reduced prior to commencement of the manoeuvre. These then increased in a consistent manner at the incipient spin stage. The rpm increased momentarily prior to the engine shutdown while the manifold pressure was low. This may have been due to increasing airspeed, low nose attitude and high rate of descent.

Figure 4: Flight data depicting engine settings



Source: ATSB

Cirrus SR22 spin recovery

The SR22 Pilot Operating Handbook (POH) stated:

> **WARNING**
>
> In all cases, if the aircraft enters an unusual attitude from which recovery is not expected before ground impact, *immediate* deployment of the CAPS is required. The minimum demonstrated altitude loss for a CAPS deployment from a one-turn spin is 920 feet. Activation at higher altitudes provides enhanced safety margins for parachute recoveries. Do not waste time and altitude trying to recover from a spiral/spin before activating CAPS.
>
> The aircraft is not approved for spins, and has not been tested or certified for spin recovery characteristics. The only approved and demonstrated method of spin recovery is activation of the Cirrus Airframe Parachute System (CAPS). Because of this, if the aircraft 'departs controlled flight,' the CAPS must be deployed.
>
> While the stall characteristics of the aircraft make accidental entry into a spin extremely unlikely, it is possible. Spin entry can be avoided by using good airmanship: coordinated use of controls in turns, proper airspeed control following the recommendations of this Handbook, and never abusing the flight controls with accelerated inputs when close to the stall.

> If, at the stall, the controls are misapplied and abused accelerated inputs are made to the elevator, rudder and/or ailerons, an abrupt wing drop may be felt and a spiral or spin may be entered. In some cases it may be difficult to determine if the aircraft has entered a spiral or the beginning of a spin.
>
> If time and altitude permit, determine whether the aircraft is in a recoverable spiral/incipient spin or is unrecoverable and, therefore, has departed controlled flight.

Cirrus engaged in an extensive flight test program to investigate the aircraft stall characteristics and spin behaviour. The proper spin recovery procedure was found to be brisk movement of the elevator control to the full down position. This was reported to be an unnatural control movement, when the nose of the aircraft may already appear to the pilot to be pointing down sharply. Cirrus determined that the probability of a typical general aviation pilot properly applying the spin recovery controls was low. The procedure in the event of loss of control of the aircraft as stated in the above extract of the POH is to activate the CAPS.

Cirrus comments

Cirrus advised that restarting the engine with the chute deployed would not provide the aircraft with forward speed to avoid obstacles; it would cause the aircraft to spin around under the canopy. The canopy can not be cut away by the pilot as it was during the aircraft testing and certification phase.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

As a result of this occurrence, the pilot in command has advised the ATSB that he is preparing a set of protocols for demonstration flights, including manoeuvres of a significantly lower level of risk than those included in the training scenarios and a more thorough pre-flight briefing.

Safety message

This incident provides a reminder to pilots to know your own limitations and those of the aircraft. This demonstrates the importance of thorough planning and preparation for every flight and also of re-assessing when forced to deviate from the plan, such as operating over higher terrain. Thorough passenger and student briefings conducted prior to the flight may assist in dealing with emergency situations. Animation from the recorded flight data of a 10-turn spin fatal Cirrus SR20 accident is available at www.youtube.com/watch?v=e7GwjMk6HuI.

General details

Occurrence details

Date and time:	10 May 2014 – 1435 EST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	near Katoomba, New South Wales	
	Latitude: 33° 43.80' S	Longitude: 150° 25.78' E

Aircraft details

Manufacturer and model:	Cirrus Design Corporation SR22	
Registration:	N802DK	
Serial number:	4046	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.